K-5 Next Generation Science Seminars

AGENDA

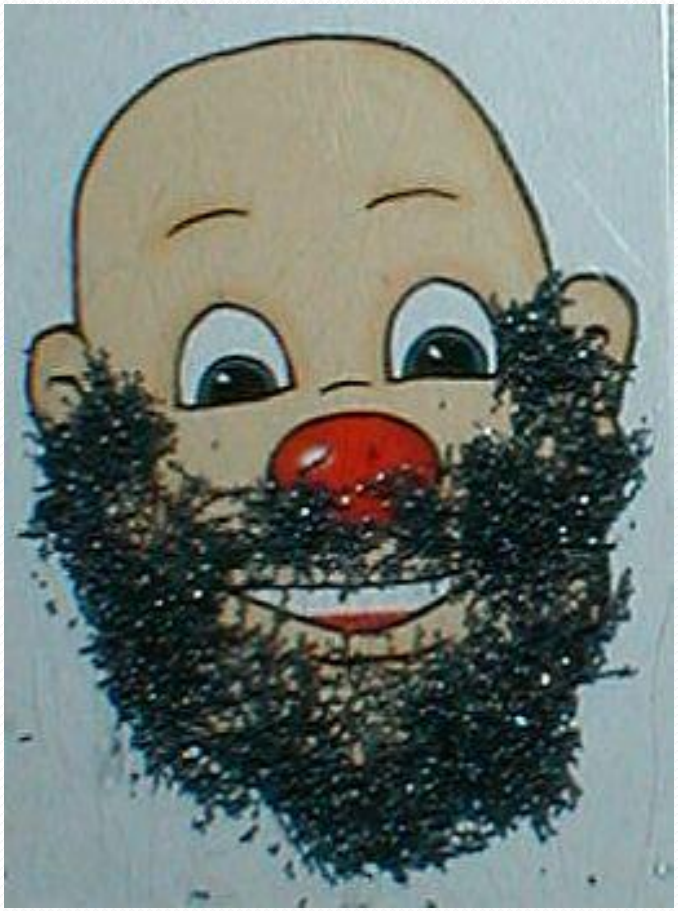
- Anchoring Event
- Break
- Bridging to Teacher Learning
- Making Meaning
- Next Steps

Engaging in Science

…remember it’s like playing pinball

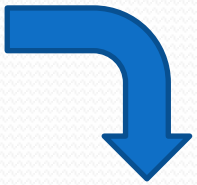
Anchoring Phenomenon

Driving Question:
How does the magic wand move Willy's whiskers to make the beard?



Model Based Inquiry

Big Ideas and Anchoring Phenomenon



Science Notebooks

On your own…

Explain what is happening when you use this toy.

Use words and pictures to describe your thinking.

Small Group Consensus

- **Discuss** Come to consensus about your explanation of the driving question.
- Using the chart paper, create a model to help others understand your thinking.
- Post it.

How does the magic wand move Willy's whiskers to make the beard?

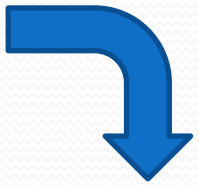
Wisdom Walk…

- **Roam** the room.
- How are others' explanations and models similar or different from your group?

How does the magic wand move Willy's whiskers to make the beard?

Model Based Inquiry

Big Ideas and Anchoring Phenomenon



Eliciting and Utilizing Initial Ideas

Scientist Meeting – Gathering Ideas

- Gather as a group
- Bring your ideas to share

How does the magic wand move Willy's whiskers to make the beard?

Break

Explore the materials.

How can they be used to explain… *the cause and effect relationships of magnetic interactions of two objects not in contact with each other?*

Be back in 15 min!!!

Let's Bridge It…

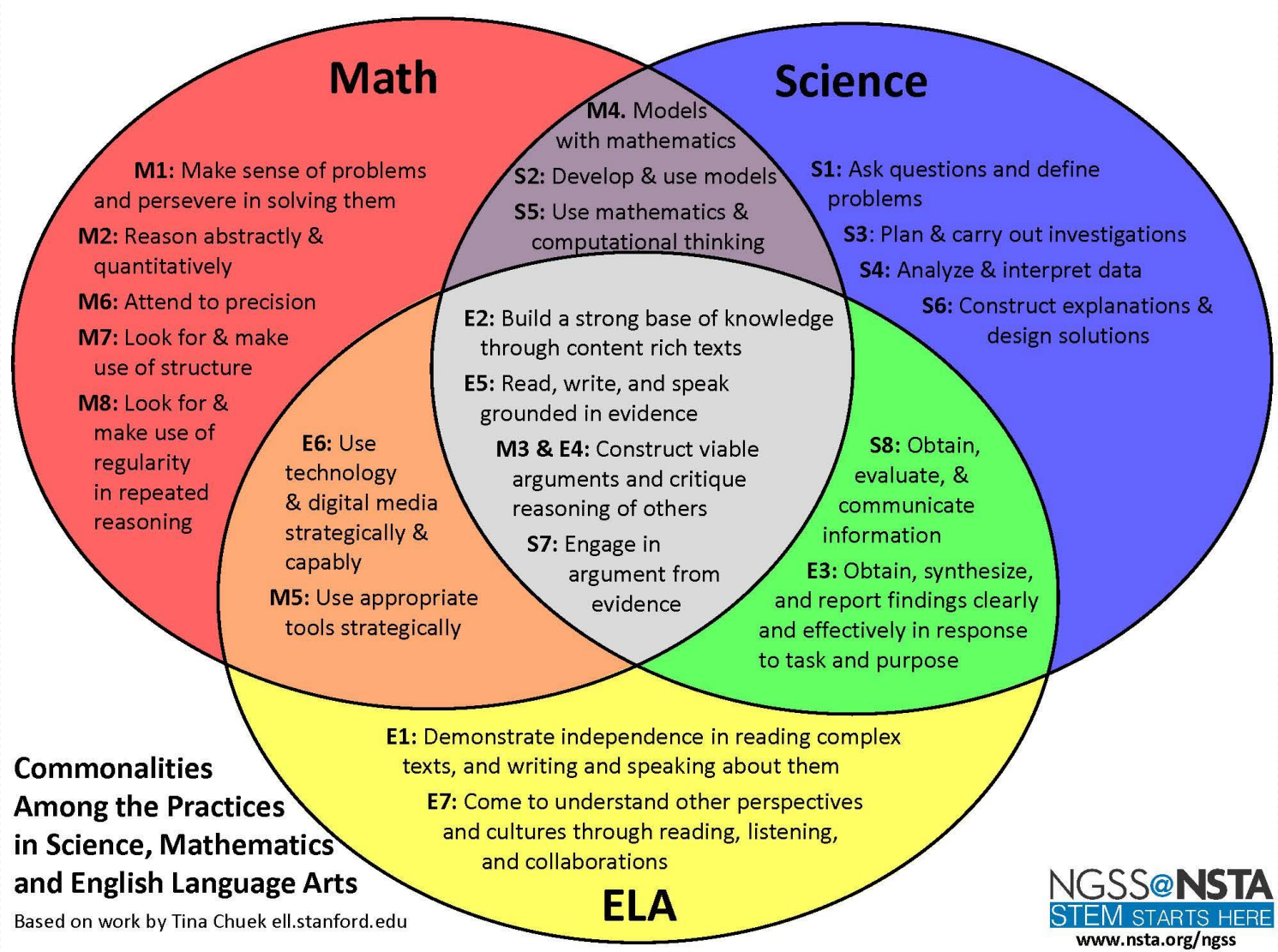
How is science instruction changing?

Integrating Literacy into Science

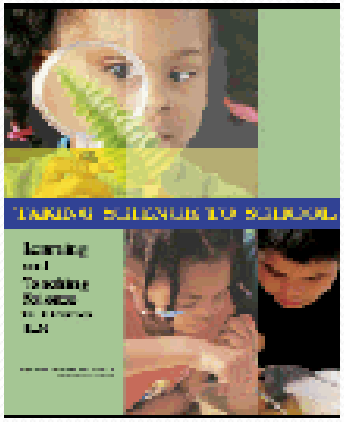
NGSS, 3 PS2 Forces and Interactions
Text Set (compiled February 2015)

Cover	Author	Title, ISBN	Copyright date, Reading Level	Description
Informational Text				
		30PS201. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.		
	Weakland, Mark	Do-4U the Robot Experiences Forces and Motion 978-1-4048-7145-8 (library binding) 978-1-4795-3096-0 (eBook)	2012. Lexile: NC 640 Fountas and Pinnell:Q	Two robots explain the basics of force and motion.
		30PS202. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future		

The Venn Diagram of ELA, Math and Science…



Building Blocks of NGSS



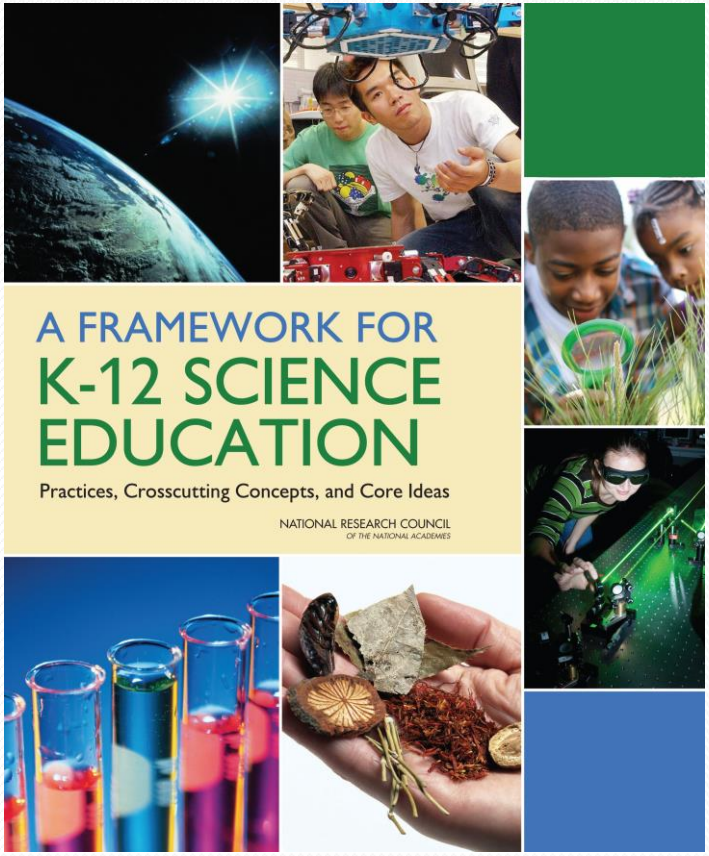
Making Meaning occurs through the integration of science and engineering practices with core conceptual ideas.

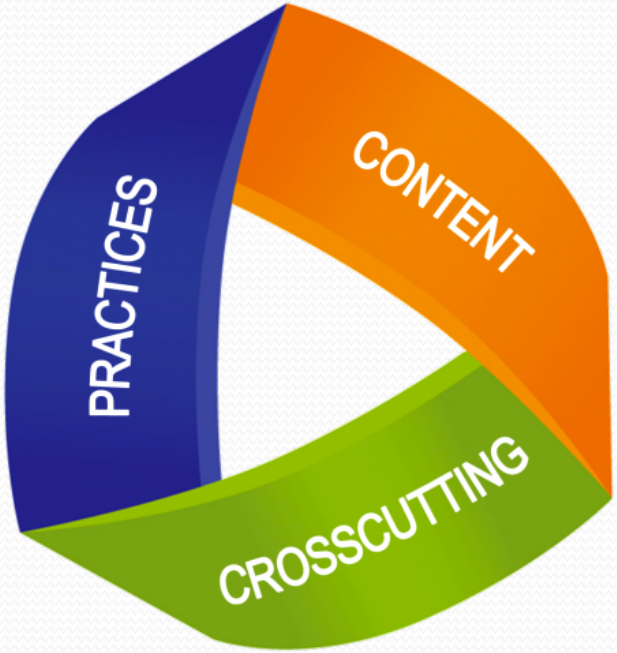
Thinking becomes visible when students have the opportunity to *experience* the science and engineering, *talk* about it, and *write* about it

Deep Understanding requires coherent curriculum and instruction as students develop increasingly sophisticated thinking.

NEXT GENERATION SCIENCE STANDARDS

Building Blocks of NGSS





NEXT GENERATION SCIENCE STANDARDS

In Groups… Reflect and Highlight

3-PS2 Motion and Stability: Forces and Interactions

3-PS2 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

3-PS2-1. **Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

3-PS2-2. **Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.** [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]

3-PS2-3. **Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.** [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]

3-PS2-4. **Define a simple design problem that can be solved by applying scientific ideas about magnets.*** [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1)
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)

Connections to Nature of Science

Science Knowledge is Based on Empirical Evidence

- Science findings are based on recognizing patterns. (3-PS2-2)

Scientific Investigations Use a Variety of Methods

Disciplinary Core Ideas

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)
- Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4)

Crosscutting Concepts

Patterns

- Patterns of change can be used to make predictions. (3-PS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified. (3-PS2-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

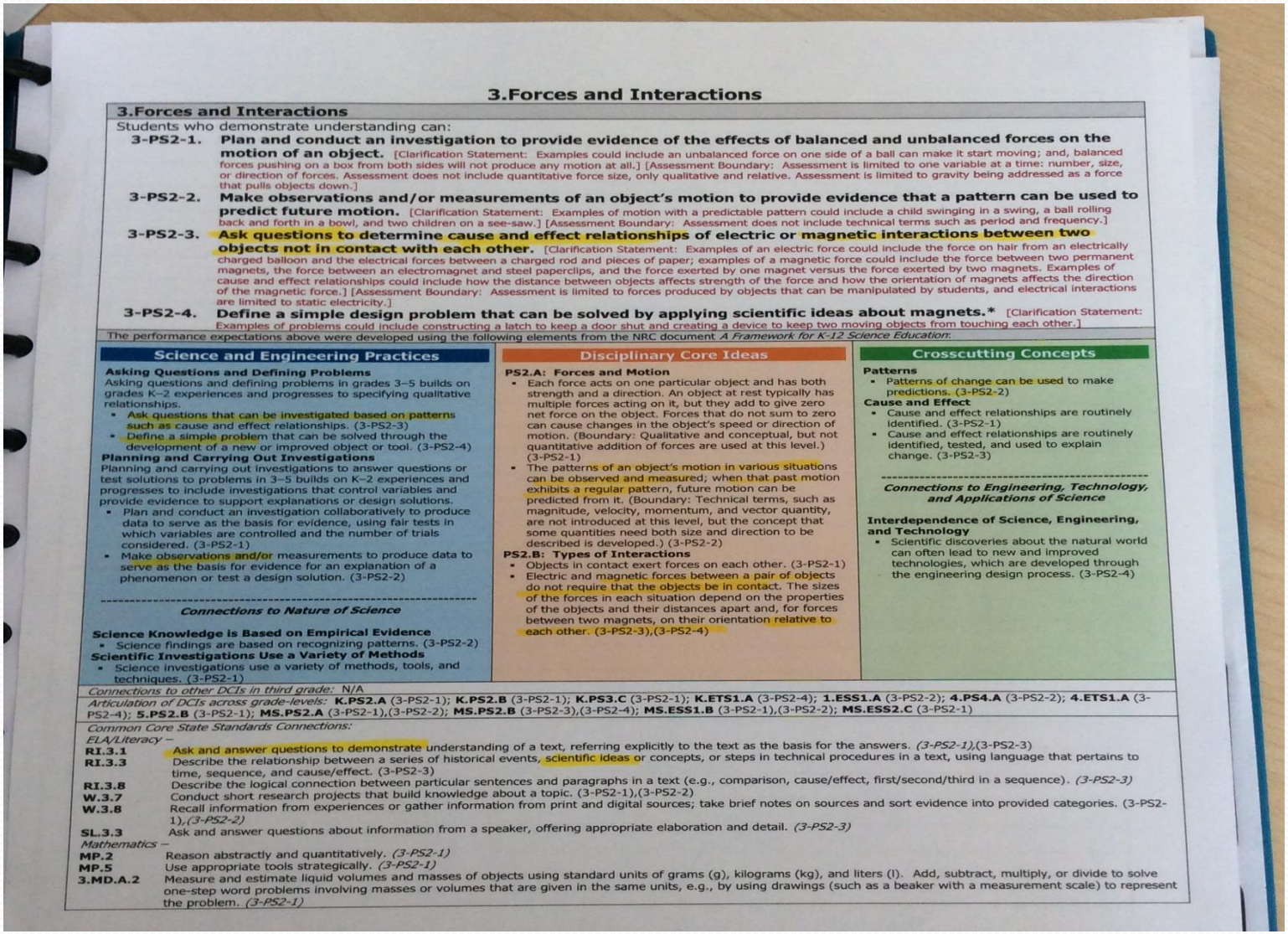
- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)

How does the magic wand move Willy's whiskers to make the beard?

Group Task

- Read the standard
- What parts of the standard connect to the driving question?
- Come to consensus and highlight:
  - Performance Expectation
  - Science and Engineering Practices
  - Disciplinary Core Ideas
  - Cross Cutting Concepts
- Be ready to report out

Highlighted Standard



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- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)

Connections to other DCIs in third grade: N/A

Articulation of DCIs across grade-levels: **K.PS2.A** (3-PS2-1); **K.PS2.B** (3-PS2-1); **K.PS3.C** (3-PS2-1); **K.ETS1.A** (3-PS2-4); **1.ESS1.A** (3-PS2-2); **4.PS4.A** (3-PS2-2); **4.ETS1.A** (3-PS2-4); **5.PS2.B** (3-PS2-1); **MS.PS2.A** (3-PS2-1),(3-PS2-2); **MS.PS2.B** (3-PS2-3),(3-PS2-4); **MS.ESS1.B** (3-PS2-1),(3-PS2-2); **MS.ESS2.C** (3-PS2-1)

Common Core State Standards Connections:

ELA/Literacy –

RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. *(3-PS2-1),*(3-PS2-3)

RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3)

RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). *(3-PS2-3)*

W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1),(3-PS2-2)

W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1),*(3-PS2-2)*

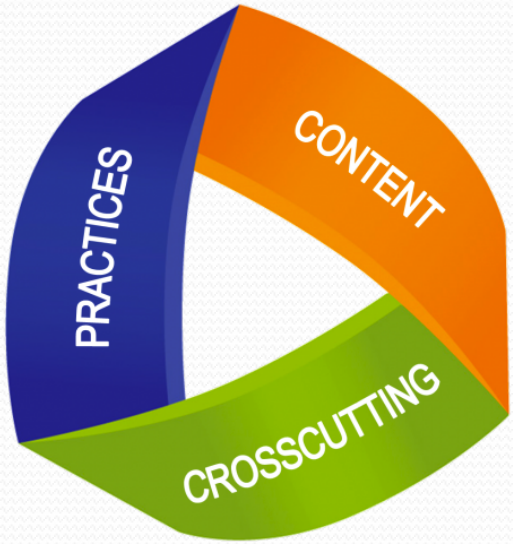
SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. *(3-PS2-3)*

Mathematics –

MP.2 Reason abstractly and quantitatively. *(3-PS2-1)*

MP.5 Use appropriate tools strategically. *(3-PS2-1)*

3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. *(3-PS2-1)*



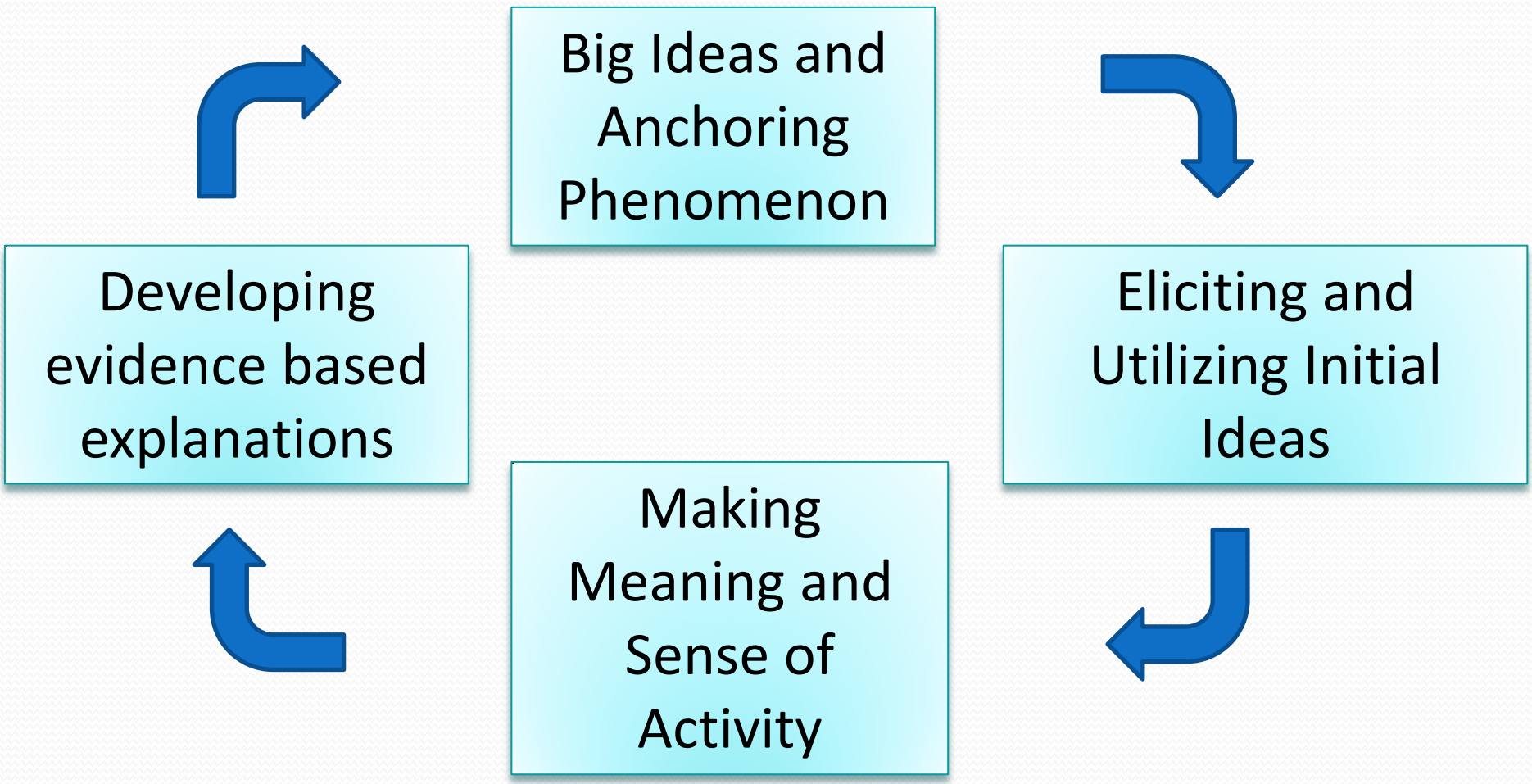
Crosscutting Concepts

Core Ideas

Practices

Integration of practices, crosscutting concepts, and core ideas.

Model Based Inquiry



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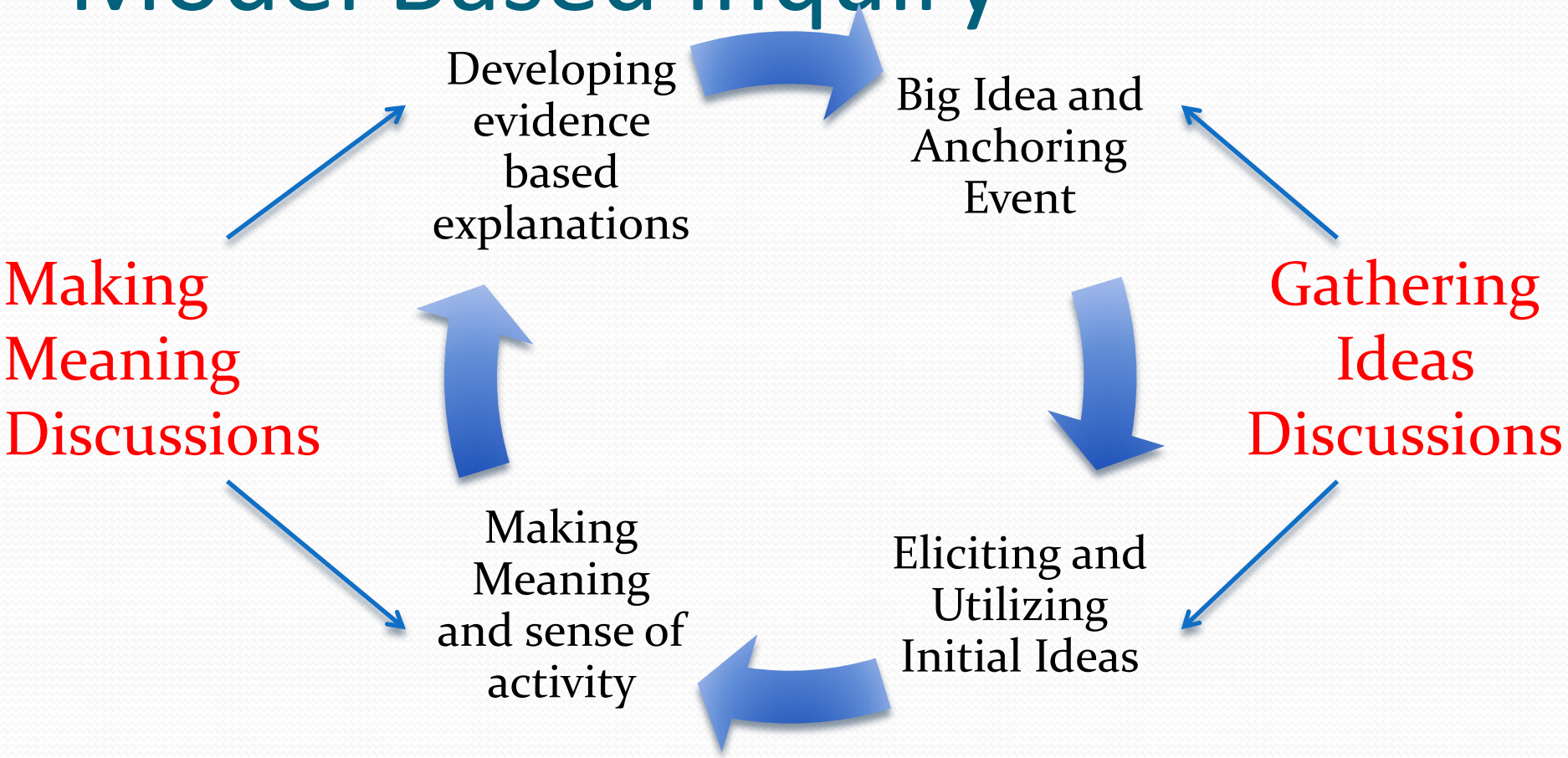

Windschitl, et al 2012

The Instructional Sequence

Next Generation Science Integrated Instructional Sequence Template

Title of Instructional Sequence_____ _____ Grade Level_____

NGSS Performance Expectation	• Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. 3-PS2-3 • Clarification Statement and Assessment Boundary • Define a simple design problem that can be solved by applying scientific ideas about magnets. 3-PS2-4 • Clarification Statement and Assessment Boundary
Essential Question(s) *Found in the Framework of K-12 Science Education*	*What underlying forces explain the variety of interactions observed?* Gravitational, electric, and magnetic forces between a pair of objects do not require that they be in contact. These forces are explained by force fields that contain energy and can transfer energy through space.
Driving Question (s)	How and why does the moving the magic wand over Willy's whiskers to make a beard?
Cross Cutting Concepts *Found in the Framework of K-12 Science Education*	Cause and effect relationships are routinely identified, tested, and used to explain change.
Disciplinary Core Ideas *Found in the Framework of K-12 Science Education*	• Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. • Science and technology support each other. • Tools and instruments are used to answer scientific questions, while scientific discoveries lead to the development of new technologies

Words: 554 80%

Making Meaning…

- Re-visit / edit your model in your Science Notebook

- Write an explanation to answer the driving question

Making Meaning…

Brainstorm Expanded Learning…

What are the avenues to deepen and apply the learning to real life?

- Libraries
- Museums
- Afterschool
- Summer Learning
- Home
- Community

THANK YOU!